

# ICCAGRA 2011 Fall Meeting – USGS Update

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## U.S. Geological Survey's UAS Project Office Gets Honeywell T-Hawks

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Based on the successful acquisition of Ravens, the US Army has recently agreed to provide the U.S. Geological Survey's Unmanned Aircraft Systems Project Office access to over 21 [Honeywell T-Hawks](#).

These smaller and more compact UAS will enhance the capabilities of the office by providing a Reconnaissance and Surveillance (R&S) System with hover, persistent stare, and vertical launch/land capabilities. The systems are currently being used to monitor the radiation levels being emitted from the Japanese Nuclear Power facilities. Potential Applications include: Observing wildfire behaviour, Verification- Validation of camera calibration test sites, Archaeological Site (cliff art) Mapping, Small area photogrammetric projects, Damage assessments, Dam Inspections, and Monitoring Volcanic Activity.

Plan as of 9/27/2011 is for USGS to obtain 22 T-Hawk III systems (2 aircraft each)



# T-Hawk™ Micro Air Vehicle

Providing unprecedented situational awareness in small unmanned platforms



## System Features

- Electronic Control Unit provides increased vehicle efficiency through fuel injection
- Packable within the standard Modular, Light Weight, Load Carrying Equipment (MOLLE) system
- Deployment and stowing operations accomplished in ten minutes
- Simple, intuitive operation requiring minimal operator training
- Interchangeable payload pods with daylight & night time cameras and user-selectable data links
- Vertical take off and landing enables hover-and-stare mission profile
- Operable from within armored vehicles
- 17.5 lbs (7.9kg) vehicle dry weight

## Specifications

### Components

- 2 T-Hawk™
- 1 ground station
- Support equipment

### Air Vehicle Performance

(at 100°F / sea-level)

- 50 minutes endurance
- 25 ft/sec (7.6m/sec) rate of climb
- 46 mph (40 knot) maximum airspeed
- Take off and landing in 17 mph (15 knot) winds
- Fly in 23 mph (20 knot) winds, rain, 10,000-foot (3,048 meter) service ceiling

### Operational Environment

- Temperature: 20°F to 120°F (-7°C to 49°C)  
(based on COTS sensors)
- Humidity: 100%
- Operates in rain, salt, fog, sand, and dust

### Payloads

- Gimballed EO and IR cameras
- Modular interchangeable sensor packaging

### Video Recording

- Ground station stores 240 minutes of sensor imagery



### Flight Modes

- Autonomous flight with dynamic re-tasking and manual intervention
- Hover-and-stare

### Flight Planning

- Up to 100 waypoints in a flight plan
- Up to 10 planned flight plans stored on ground station
- Multiple loiter patterns

### Acoustics

- 75 dBA at 328 ft (100m)

### Fuel

- Gasoline, non-volatile lubricants

### Communications

- 3-6 mile (5-10km) range with common military UAV frequencies

### Navigation

- 10-meter horizontal position accuracy
- 19.6 ft (6m) pressure altitude accuracy
- Inertial and GPS with SAASM capabilities



USGS Raven RQ-11A

As one of its first accomplishments, the USGS UAS Project Office established a strategic partnership with the U.S. Army and able to obtain access to seventeen unmanned aerial system (sUAS). The Ravens are categorized as Group 1 UA (Table 1). The AeroVironment produced system is a hand launched sUAS primarily designed as a reconnaissance and surveillance tool (Figure 1). The system transmits near real time airborne video images, compass headings and GPS location information to a ground control unit (GCU) and remote video terminal (RVT). The optics package includes an electro-optical (EO) color camera nose payload (side and forward looking) on the same payload and two infrared (IR) thermal nose payloads (a side look payload or a forward look payload). These initial systems have already proved to be invaluable in promoting and developing sUAS technology for civil and domestic applications.

Categories of UAS

Group	Overall Weight	Flight Height	Speed
1 UA	<20 lbs.	<1,200 feet AGL	<250 kts.
2 UA	21-55 lbs.	<3,500 feet AGL	<250 kts.
3 UA	55 - 1,320 lbs.	<18,000 feet MSL	<250 kts.
4 UA	>1,320 lbs	<18,000 feet MSL	Any Speed
5 UA	>1,320 lbs.	>18,000 feet MSL	Any Speed

Source: Office of the Secretary of Defense, Unmanned Systems Integrated Roadmap 2009-2034 (Washington, DC: Government Printing Office, 6 April 2009), pp. 96-97.

Plan as of 9/27/2011 is for USGS to obtain 20 Raven Systems (each system consisting of 3 aircraft) – currently have a total of 24 Ravens

## *Sand Hill Crane Population Estimates*

The Department of the Interior (DOI) conducted the first small unmanned aerial system (UAS) mission using the Raven RQ-11A UAS from March 19-24, 2011, at Monte Vista National Wildlife Refuge near Monte Vista, Colorado. The U.S. Geological Survey (USGS) utilized the Raven RQ-11A UAS in cooperation with the U.S. Fish and Wildlife Service (USFWS) to determine the feasibility of using an UAS to survey Sandhill Cranes to derive methodology for estimating population surveys. This mission was the first operation conducted by the DOI in National Airspace System (NAS) using the Federal Aviation Administration's (FAA) Certificate of Authorization (COA) process.

Sandhill Cranes are migratory birds that travel from Texas to Idaho (and as far as Siberia) annually. The Monte Vista Wildlife Refuge plays a key role for the greater Sandhill Crane species serving as a stopover point for roosting cranes during migration. Traditionally, Sandhill Crane population surveys were conducted using fixed-wing aircraft, placing both birds and staff at risk of mid-air collisions, or ground-count methods where biologists in the field attempt to enumerate the birds with sectional surveys.

The objective of this proof of concept operation was to determine if the Raven's sensor package was capable of picking up the cranes thermal signatures. Concerns regarding the cranes behavior to the Raven UAS were to be determined and addressed depending on findings. The behavior report of the cranes reactions to the UAS varied greatly on the time of day, and the type of environment the bird was actively utilizing (i.e. roosting, feeding, or loafing).

Many milestones were reached during this project, notably, the first approved UAS flight in the NAS for the Department of the Interior. Special thanks for the collaboration efforts across the bureaus include, USGS, USFWS, and the Aviation Management Directorate (AMD).

For full project description and findings, see [Sandhill Crane Population Surveys Information Sheet](#)

[AUSVI Magazine Article June 2011](#)

[EI Journal Article September/October 2011](#)

[Mission Poster](#)

[Mission Photos and Video](#)



A Sandhill Crane dances in courtship.



Raven A Infra-Red Thermal Imagery of roost, black is hot, Cranes are white against the warm-water roost, taken 6:39 am 3/24/11.

## UAS: Dragon Eye

Dragon Eye, the choice of the U.S. Marine Corps, is a fully autonomous, back-packable, bungee launched UAS designed to provide “over-the-next-hill” tactical reconnaissance and surveillance information.

With a wingspan of 3.75 feet and a weight of 5.9 pounds, the Dragon Eye airplane provides aerial observation at line-of-sight ranges of up to 5 kilometers. Using GPS navigation, the Dragon Eye autonomously flies from operator programmable waypoints. The Dragon Eye’s electric motors provide an extremely low noise signature, and the small wingspan makes it difficult to detect in flight.

Dragon Eye’s payloads are capable of real-time, high-resolution color or infrared imaging. In addition to viewing imagery in real time, this small UAS enables the operator to “click capture” and store still images on the mission-programming computer.

Plan as of 9/27/2011 is for DOI to obtain 25 Dragon Eye Systems (each system consisting of 3 aircraft) – 6 Dragon Eye aircraft currently scheduled for delivery in early FY12.



# Upcoming Events

- October 2011
  - Raven UAS Training in Boise Idaho
  - Sandhill Crane Night Ops (10-14 October) – thermal instrument
- November 2011
  - OSMRE project – assess acid mine pollution in WV
- Proposed FY12
  - Work with Johns Hopkins Volcano Hazards Program – assess chemical composition
  - Spring work with NOAA quad copter (Raven and T-Hawk tests)



# NEO Assessment Team

- OSTP Driven
- Remote Sensing Assets as relates to Societal Benefits focus
- Working Group currently developing a plan to gather most critical societal benefit related requirements and come up with an assessment plan
  - NASA (Dave Halpern)
  - NOAA (Pam Taylor)
  - USGS (Bruce Quirk)
- May have funding implications as early as FY14
- Agency solicitations expected beginning early CY12